AQUATIC INVERTEBRATES AND HABITAT AT A FIXED STATION ON THE JEFFERSON RIVER, BROADWATER AND GALLATIN COUNTIES, MONTANA

July 12, 2001

A report to
the Montana Department of Environmental Quality
Helena, Montana

by
Wease Bollman
Rhithron Associates, Inc.
Missoula, Montana
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INTRODUCTION

This report is one of 38 brief interpretive summaries of data assembled as part of a statewide, multi-year study conducted by the Montana Department of Environmental Quality (MT DEQ). Each report discusses information generated from a single benthic invertebrate sample collection and habitat evaluation at a fixed station established on a gauged river or high-order tributary. The present treatise focuses on the aquatic community sampled on the Jefferson River near Three Forks, Montana on July 12, 2001. The sample site was located by GPS reading at 45° 53' 41" N, 111° 35' 56" W, lying within the Montana Valley and Foothill Prairie Ecoregion (Woods et al. 1998). The sample was collected by personnel of MT DEQ. Sampling effort consisted of either a composite of four Hess samples, or a one-minute kicknet collection (Bukantis 1998). Habitat parameters were evaluated using the MT DEQ Macroinvertebrate Habitat Assessment Field Form for streams with riffle/run prevalence. Invertebrate samples were processed and animals identified by Rhithron Associates, Inc. Analysis of invertebrate assemblages was accomplished by applying the revised method (Bollman 1998) for streams of Western Montana's ecoregions. The method uses a multimetric battery to evaluate disturbance to biotic integrity.

The revised bioassessment metric battery and its scoring criteria have not been evaluated for application to higher-order streams and rivers; to date, no bioassessment method has been contrived for these waterways in Montana. Thus, the method used here is likely to have limitations in its applicability to the sites in this study. For example, 24 of the riverine or high-order waterways sampled for the fixed station study were located within Western Montana ecoregions and were sampled between July 23 and August 25, 2001. Mean water temperature for these sites at the time of sampling was 19.8°C (median = 19.4°). Temperatures ranged from 15.5°C (Kootenai River near Libby) to 25.3°C (Jefferson River near Three Forks). Ninety-eight sites from Western Montana were used to assemble the revised metric battery and to test it for sensitivity in detecting impairment, to establish scoring criteria, and to improve robustness of bioassessment. These 98 sites were mainly second and third order streams; the sampling season roughly corresponded to that of the fixed-station study. Mean water temperature for these sites at the time of sampling was 15°C (median = 14°C). Natural variations in benthic community composition and structure along longitudinal and thermal gradients are well known phenomena. Thus, scores and classifications were established for much smaller systems with significantly lower water temperatures; impairment classifications and use support designations in this study must be interpreted with care. Results from the application of other metric batteries may be found in the Appendix.

RESULTS AND DISCUSSION

Table 1 itemizes the nine evaluated habitat parameters and shows the assigned scores for each, as well as the integrated score and condition category.

Overall habitat conditions scored marginally at this site on the Jefferson River. Instream habitats were perceived to be limited by substrate embeddedness and fine sediment deposition. Riffle development was judged sub-optimal. Channel alteration was observed to affect the right side of the river; channel morphology was appraised as marginal.

Streambanks were unstable on the right bank, and only moderately stable on the left. Associated with bank instability was extensive disruption of vegetative protection, especially on the right bank. The riparian zone width was judged marginal.

Flow conditions were perceived to be sub-optimal.

Table 1. Stream and riparian habitat assessment for a fixed station on the Jefferson River. July 2001.

Max. possible score	**Parameter**	Jefferson River near Three Forks
10	Riffle development	8
10	Benthic substrate	8
20	Embeddedness	13
20	Channel alteration	8
20	Sediment deposition	13
20	Channel flow status	14
20	Bank stability: left / right	6 / 1
20	Bank vegetation: left / right	5 / 1
20	Vegetated zone: left / right	5 / 3
160	Total	85
	Percent of maximum CONDITION*	**53 MARGINAL**

*Condition categories: Optimal > 80% of maximum score; Sub-optimal 75 - 56%; Marginal 49 - 29%; Poor <23%. Adapted from Plafkin et al. 1998.

Table 2. Metric values, scores, and bioassessment for a fixed station on the Jefferson River. The revised bioassessment metric battery (Bollman 1998) was used for the evaluation. July 2001.

	Jefferson River near Three Forks	
METRICS	**METRIC VALUES**	**METRIC SCORES**
Ephemeroptera richness	7	3
Plecoptera richness	2	2
Trichoptera richness	7	3
Number of sensitive taxa	0	0
Percent filterers	41.7	0
Percent tolerant taxa	54.3	0
	TOTAL SCORE (max.=18)	8
	PERCENT OF MAX.	**44**
	Impairment classification	**MODERATE**
	USE SUPPORT	**PARTIAL**

Bioassessment results are given in Table 2. When this bioassessment method is applied to these data, scores indicate that this site on the Jefferson River is moderately impaired and only partially supports designated uses.

While the biotic index value (4.81) was higher than expected for a stream in this region, the mayfly taxa richness (7) was within expectations. The mayfly fauna, however, included several taxa tolerant of warm water conditions, such as *Hexagenia limbata*, and *Tricorythodes minutus*. These findings suggest that the benthic assemblage may have been limited by warm water temperatures. The measured water temperature at the time of sampling was 25.3°C, the highest recording of any riverine site in Western Montana visited for the fixed stations study.

The presence of thirteen "clinger" taxa and 7 caddisfly taxa suggest that hard substrates unimpaired by fine sediment deposition were available for colonization. However, the presence of some fine sediment was indicated by the presence of the burrowing mayfly *Hexagenia limbata*. Seven percent of the animals present in the sample were in taxa preferring fine sediment habitats. The stonefly fauna was limited to 2 taxa, and stonefly abundance was low. Low stonefly richness and abundance may be associated with disruption of reach-scale habitat features such as channel integrity, streambank stability, or riparian zone function. Abundant *Hydroptila* sp. suggests that filamentous algae may have been abundant as well.

All expected functional components of a healthy riverine benthic assemblage were represented in the sample, though scrapers seemed to be in short supply.

CONCLUSIONS

- Warm water temperature characterized this site on the Jefferson River and shaped the composition of the benthic assemblage.
- Fine sediments and filamentous algae were likely abundant at the site, evidenced by the taxonomic components of the fauna.
- The bioassessment method employed appears to have assigned an appropriate impairment classification to the site, but the bioassessment score may underestimate the quality of the fauna to some extent. In particular, the proportion of filter-feeders seems appropriate for a riverine environment, and the contribution of tolerant taxa is only moderately elevated over expectations.

LITERATURE CITED

Bollman, W. 1998. Improving Stream Bioassessment Methods for the Montana Valleys and Foothill Prairies Ecoregion. Master's (M.S.) Thesis. University of Montana. Missoula, Montana.

Bukantis, R. 1998. Rapid bioassessment macroinvertebrate protocols: Sampling and sample analysis SOP's. Working draft, April 22, 1997. Montana Department of Environmental Quality. Planning Prevention and Assistance Division. Helena, Montana.

Woods, A.J., Omernik, J. M. Nesser, J.A., Shelden, J., and Azevedo, S. H. 1999. Ecoregions of Montana. (Color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia. US Geological Survey.

APPENDIX

Taxonomic data and summaries

Jefferson River

July 2001

Aquatic Invertebrate Taxonomic Data

Site Name: Jefferson River near Three Forks **Date: 7/12/01**

Site ID: M08JEFFR01 Approx. percent of sample used: 17

Taxon	Quantity	Percent	HBI	FFG
Nematoda	1	0.33	11	PA
Ferrissia sp.	1	0.33	6	SC
Total Misc. Taxa	**2**	**0.66**		
Acentrella turbida	2	0.66	4	CG
Baetis tricaudatus	27	8.94	4	CG
Plauditus sp.	1	0.33	4	CG
Hexagenia limbata	4	1.32	6	CG
Rhithrogena sp.	2	0.66	0	CG
Paraleptophlebia sp.	1	0.33	1	CG
Tricorythodes minutus	21	6.95	4	CG
Total Ephemeroptera	**58**	**19.21**		
Claassenia sabulosa	1	0.33	3	PR
Isogenoides sp.	6	1.99	3	PR
Total Plecoptera	**7**	**2.32**		
Corixidae - immature	1	0.33	10	UN
Total Hemiptera	**1**	**0.33**		
Brachycentrus occidentalis	12	3.97	2	CF
Culoptila sp.	2	0.66	1	SC
Helicopsyche borealis	8	2.65	3	SC
Cheumatopsyche sp.	45	14.90	5	CF
Hydropsyche sp.	66	21.85	5	CF
Hydroptila sp.	39	12.91	6	PH
Oecetis sp.	1	0.33	8	PR
Total Trichoptera	**173**	**57.28**		
Microcylloepus sp.	7	2.32	5	SC
Optioservus sp.	5	1.66	5	SC
Zaitzevia sp.	10	3.31	5	CG
Total Coleoptera	**22**	**7.28**		
Ceratopogoninae	1	0.33	6	PR
Simulium sp.	3	0.99	5	CF
Total Diptera	**4**	**1.32**		
Corynoneura sp.	1	0.33	7	CG
Cricotopus Trifascia Gr.	1	0.33	7	CG
Paratanytarsus sp.	7	2.32	6	UN
Polypedilum sp.	12	3.97	6	SH
Rheocricotopus sp.	1	0.33	4	CG
Thienemanniella sp.	2	0.66	6	CG
Thienemannimyia Gr.	5	1.66	5	PR
Tvetenia sp.	6	1.99	5	CG
Total Chironomidae	**35**	**11.59**		
Grand Total	**302**	**100.00**		

Aquatic Invertebrate Summary

Site Name: Jefferson River near Three Forks **Date: 7/12/01**

SAMPLE TOTAL	302
EPT abundance	238
TAXA RICHNESS	32
Number EPT taxa	16
Percent EPT	78 81

Site ID: M08JEFFR01

DOMINANCE

TAXON	ABUNDANCE	PERCENT
Hydropsyche sp	66	21 85
Cheumatopsyche sp	45	14 90
Hydroptila sp	39	12.91
Baetis tricaudatus	27	8 94
Tricorythodes minutus	21	6 95
SUBTOTAL 5 DOMINANTS	198	65 56
Brachycentrus occidentalis	12	3 97
Polypedilum sp	12	3 97
Zaitzevia sp	10	3 31
Helicopsyche borealis	8	2 65
Microcylloepus sp	7	2 32
TOTAL DOMINANTS	247	81 79

SAPROBITY

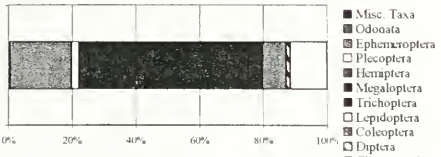
Hilsenhoff Biotic Index	4 81

DIVERSITY

Shannon H (loge)	2 30
Shannon H (log2)	3 32
Simpson D	0 10

TAXONOMIC COMPOSITION

GROUP	PERCENT	#TAXA	ABUNDANCE
Misc Taxa	0 66	2	2
Odonata	0 00	0	0
Ephemeroptera	19 21	7	58
Plecoptera	2 32	2	7
Hemiptera	0 33	1	1
Megaloptera	0 00	0	0
Trichoptera	57 28	7	173
Lepidoptera	0 00	0	0
Coleoptera	7 28	3	22
Diptera	1.32	2	4
Chironomidae	11 59	8	35



VOLTINISM

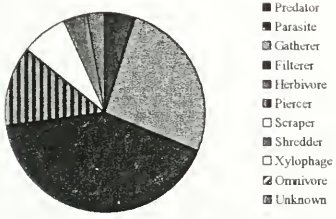
TYPE	ABUNDANCE	PERCENT
Multivoltine	107	35 35
Univoltine	158	52 40
Semivoltine	37	12 25

TAXA CHARACTERS

	#TAXA	ABUNDANCE	PERCENT
Tolerant	10	164	54 30
Intolerant	0	0	0 00
Clinger	13	212	70 20

FUNCTIONAL COMPOSITION

GROUP	PERCENT	#TAXA	ABUNDANCE
Predator	4 64	5	14
Parasite	0 33	1	1
Gatherer	26 16	13	79
Filterer	41 72	4	126
Herbivore	0 00	0	0
Piercer	12 91	1	39
Scraper	7 62	5	23
Shredder	3 97	1	12
Xylophage	0 00	0	0
Omnivore	0 00	0	0
Unknown	2 65	2	8



BIOASSESSMENT INDICES

B-IBI (Karr et al.)

METRIC	VALUE	SCORE
Taxa richness	32	3
EPT richness	7	3
PT richness	2	1
TT richness	7	3
Long-lived	4	3
Sensitive richness	0	1
%tolerant	54 30	1
%predators	4 64	1
Clinger richness	13	3
%dominance (3)	49 67	5
	TOTAL SCORE	24

48 %

MONTANA DEQ METRICS (Bukantis 1998)

METRIC	VALUE	Plains Ecoregions	Valleys and Foothills	Mountain Ecoregions
Taxa richness	32	3	3	3
EPT richness	16	3	3	1
Biotic Index	4 81	3	2	1
%Dominant taxon	21 85	3	3	3
%Collectors	67 88	2	2	2
%EPT	78 81	3	3	3
Shannon Diversity	3 32	3		
%Scrapers +Shredd	11 59	1	1	0
Predator taxa	5	2		
%Multivoltine	35 35	3		
%H of T	64		3	
TOTAL SCORES		26	20	13
PERCENT OF MAXIMUM		86 67	83 33	61 90
IMPAIRMENT CLASS		NON	NON	SLIGHT

COMMUNITY TOLERANCES

Sediment tolerant taxa	2
Percent sediment tolerant	7 28
Sediment sensitive taxa	0
Percent sediment sensitive	0 00
Metals tolerance index (McGuire)	4 25
Cold stenotherm taxa	0
Percent cold stenotherms	0 00

Montana DEQ metric batteries